

REMARKS

The Final Office Action dated November 1, 2004, has been received and reviewed.

Claims 1-13 are currently pending and under consideration in the above-referenced application, each standing rejected.

Reconsideration of the above-referenced application is respectfully requested.

Supplemental Information Disclosure Statement

Please note that a Supplemental Information Disclosure Statement was filed in the above-referenced application on October 8, 2004, but that the undersigned attorney has not yet received any indication that the reference cited in the Supplemental Information Disclosure Statement has been considered in the above-referenced application. It is respectfully requested that the reference cited in the Supplemental Information Disclosure Statement of October 8, 2004, be considered and made of record in the above-referenced application and that an initialed copy of the Form PTO/SB/08A that accompanied that Supplemental Information Disclosure Statement be returned to the undersigned attorney as evidence of such consideration.

Rejections Under 35 U.S.C. § 103(a)

Claims 1 through 13 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is assertedly unpatentable over that taught in U.S. Patent 5,286,344 to Blalock et al. (hereinafter "Blalock"), in view of teachings from U.S. Patent 5,428,240 to Lur (hereinafter "Lur").

The standard for establishing and maintaining a rejection under 35 U.S.C. § 103(a) is set forth in M.P.E.P. § 706.02(j), which provides:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both

be found in the prior art, and not based on applicant's disclosure.
In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Independent claim 1 recites a semiconductor device that includes a semiconductor substrate, at least one conductive line on an active surface of the semiconductor substrate, sidewall spacers flanking the at least one conductive line, and an undoped silicon dioxide cap over and in contact with the at least one conductive line. In addition, a passivation layer is disposed over the undoped silicon dioxide cap. At least one contact aperture is defined through the passivation layer. The at least one contact aperture includes at least one sidewall that extends substantially perpendicular relative to the semiconductor substrate. At least a portion of the at least one sidewall terminates at an interface between the passivation layer and the undoped silicon dioxide cap.

Independent claim 6 is directed to a semiconductor device that includes a semiconductor substrate, at least one undoped silicon oxide structure, and at least one doped silicon oxide structure over the at least one undoped silicon oxide structure. The at least one doped silicon oxide structure includes at least one sidewall that is oriented substantially perpendicular to a plane of the semiconductor substrate. At least a portion of the at least one sidewall terminates at an interface between the at least one doped silicon dioxide structure and the at least one undoped silicon oxide structure.

While the claims clearly recite structures rather than processes, it should be noted that one of ordinary skill in the art would readily recognize that certain types of processes may not be used to form certain structural features. For example, it would be apparent to one of ordinary skill in the art that a contact aperture with a sidewall that extends substantially perpendicular relative to a semiconductor substrate (independent claim 1) or a plane of the substrate (independent claim 6) could not be formed by isotropic etch processes, which remove material in all directions at the same rate. *See, e.g.*, Wolf, *Silicon Processing for the VLSI Era—Vol. 1*, page 522 (Lattice Press, 1986) (hereinafter “Wolf”), a copy of the relevant pages of which is enclosed for the sake of convenience. Consequently, the processes that are used to form prior art structures may be relevant to the applicability of such references to the claims that are currently pending in the above-referenced application.

Turning now to the art upon which the Office relies in rejecting claims 1-13, Blalock teaches a semiconductor device that includes a semiconductor substrate with an active surface, at least one conductive line disposed upon the active surface, sidewall spacers flanking the at least one conductive line, and a silicon nitride cap over the at least one conductive line. In addition, the semiconductor device that is taught in Blalock includes a passivation layer over the silicon nitride cap. The sidewalls of contact apertures that have been formed through the passivation layer terminate at the silicon nitride cap and are oriented substantially perpendicular relative to the semiconductor substrate.

The substantially perpendicular orientation of the sidewalls is due to the use of anisotropic, dry (plasma) etch techniques. *See* col. 6, lines 31-52. The silicon nitride cap acts as an etch stop when the contact apertures are being etched into a silicon dioxide passivation layer. Col. 6, lines 31-33; *see also* col. 4, line 4, to col. 5, line 41; col. 6, line 53, to col. 9, line 26. The silicon dioxide passivation layer may be formed from either doped or undoped silicon dioxide (col. 6, lines 9-16), as the processes that are taught in Blalock are useful for etching *both* doped and undoped silicon dioxide with selectivity over silicon nitride.

Lur teaches semiconductor device structures that include etch stop layers that may also function as caps for conductive lines. The etch stop layers are preferably formed from silicon nitride, but may also be formed from boron nitride or undoped silicon dioxide. Col. 5, lines 29-35. While Lur notes that the etch stop layers taught therein have a greater etching resistance than that of an overlying borophosphosilicate glass (BPSG) layer (col. 5, lines 32-35), Lur does not specify whether an undoped silicon dioxide etch stop layer would be effective in an anisotropic etch process.

It is respectfully submitted that a *prima facie* case of obviousness has not been established against independent claim 1, independent claim 6, or any of claims 2-5 or 7-13 depending therefrom for at least two reasons.

First, before the priority date for the above-referenced application, one of ordinary skill in the art would not have been motivated to combine the teachings of Blalock and Lur in such a way as to render the subject matter in any of these claims obvious.

More specifically, the teachings of Blalock are directed to silicon oxide etching processes in which silicon nitride is useful as an etch stop. Blalock teaches that these processes do not discriminate between doped silicon oxides and undoped silicon oxides.

Lur teaches that wet or dry etch processes may be used to etch a BPSG (doped silicon dioxide) layer using a silicon nitride etch stop layer 28 (col. 5, lines 10-18), and that boron nitride or undoped silicon dioxide may be used in place of silicon nitride to form the etch stop layer 28 (col. 5, lines 29-35). Thus, Lur does not clearly indicate which type of etch processes (wet or dry) may be used when undoped silicon dioxide is employed as the etch stop layer 28.

Further, Lur does not specify whether the wet or dry etch processes are isotropic or anisotropic and, thus, capable of being used to form features (*i.e.*, aperture side walls) having the characteristics that are required by independent claims 1 and 6 of the above-referenced application. *See* Wolf, page 529, which suggests that wet etch processes may be anisotropic, and page 539, which suggests that dry etch processes may be isotropic.

Moreover, neither Blalock nor Lur provides a clear teaching or suggestion that the etch process disclosed therein could be used to form a side wall having the characteristics required by independent claims 1 and 6 of the above-referenced application (*i.e.*, a sidewall that extends substantially perpendicular relative to a substrate (independent claim 1) or a plane of the substrate (independent claim 6) and that at least a portion of the sidewall terminates at an interface between the passivation layer (independent claim 1) or doped silicon oxide structure (independent claim 6) by which the sidewall is defined and an undoped silicon oxide structure).

Accordingly, it is respectfully submitted that Blalock and Lur would not have provided one of ordinary skill in the art with any motivation to combine the teachings of these references in such a way as to replace the silicon nitride caps of Blalock with an undoped silicon oxide etch stop, as taught in Lur. Rather, the only source for such motivation appears to have been hindsight provided by the disclosure of the above-referenced application.

Second, it is respectfully submitted that one of ordinary skill in the art would have had no reason to expect that the asserted combination of teachings from Blalock and Lur would have resulted in the structures recited in claims 1-13 of the above-referenced application. If the

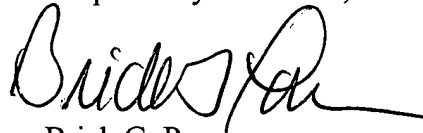
undoped silicon oxide etch stop were merely substituted for the silicon nitride layer of Blalock, due to lack of selectivity for the disclosed etchant between doped and undoped silicon oxides, etching of the overlying doped silicon dioxide layer would continue on into the undoped silicon dioxide film. Lur also fails to teach or suggest any specific etchants that could be used to form sidewalls having the characteristics that are recited in independent claims 1 and 6. Therefore, one of ordinary skill in the art would have no reason to expect the asserted combination of teachings from Blalock and Lur to be successful.

In view of the foregoing, it is respectfully submitted that a *prima facie* case of obviousness has not been established against any of claims 1-13. Thus, each of claims 1-13 recites subject matter which is allowable over the teachings of Blalock and Lur. It is, therefore, requested that the 35 U.S.C. § 103(a) rejections of claims 1-13 be withdrawn.

CONCLUSION

It is respectfully submitted that each of claims 1-13 is allowable. An early notice of the allowability of each of these claims is respectfully solicited, as is an indication that the above-referenced application has been passed for issuance. If any issues preventing allowance of the above-referenced application remain which might be resolved by way of a telephone conference, the Office is kindly invited to contact the undersigned attorney.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Brick G. Power", written over a horizontal line.

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